

# TOWN MEETING



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## "THE ATOM: ITS HAZARDS AND BENEFITS"

ANNOUNCER: To preside as moderator for tonight's discussion, here is Yale Newman, London representative for the ABC network. Mr. Newman!

MR. NEWMAN: Almost since the beginning of time, man has had to wrestle with the elements of nature for his own survival; but as man progressed, his tampering with nature introduced, rather than diminished, many of the problems he had normally to face. A discovery as elementary in our society today as fire is a point at hand. When kept under control, fire can bring warmth to the kitchen hearth, provide us with a means to sustain our daily diet, and make possible many of the necessities and comforts of our twentieth century society. But fire, once out of control, like Dr. Jekyll, becomes a menacing Mr. Hyde. It can destroy our homes, raze our forests, gut our cities, and bring death to our population.

Unfortunately, the world today is faced with a scientific discovery -- nuclear energy, which, if it gets out of control, has a destructive potential far greater than anything yet known to man. Like fire, it can bring us benefits undreamed of before, providing man is its master and not mastered by it. Just what are the hazards involved in this new discovery, what do we actually know about the subject, and how much more must we know before this Mr. Hyde of the scientific world can safely be brought into our society as a friend, rather than foe. For the answers to some of these questions, Town Hall tonight has invited four eminent men of the scientific and political world to discuss the question -- "THE ATOM: ITS HAZARDS AND BENEFITS". Our first speaker is the Right Honorable Walter Elliott, a prominent member of the Conservative Party in the House of Commons and a former cabinet officer in the pre-war Tory government. Mr. Elliott!

MR. ELLIOTT: This whole question suddenly came alive for the man in the street in Britain oddly enough not with the bombs -- they were, after all, a long way off -- it arose with the program announced by the Government early this year for twelve big atomic power stations to be begun here, almost immediately. Now it's true we were interested in the bomb tests in Nevada, and even more in our own atom bomb tests off the coast of Australia. But taken by and large, the Britisher thinks of Bikini as the name of a bathing place. But Britain is intensely interested in the fuel shortage. For the rest of the world it's a coming fuel shortage and a long way ahead at that. But in Britain the fuel shortage is here. Our coal seams are running out. We are already importing oil on a grand scale, and we are actually beginning to import coal in very substantial quantities also. So the electricity from the big nuclear power stations is literally a matter of life and death to us here in Britain. Whatever the risks, we intend to take them. After all, this island lives on risks.

MR. NEWMAN: Thank you Mr. Elliott. Our next speaker is Professor Alexander Haddow, Professor of Experimental Pathology at the University of London. He is also Director of the Research Institute of the Royal Cancer Hospital in London, a fellow of the Royal Society of Medicine, and president of the comparative medicine section. In 1948 Professor Haddow was awarded the Catherine Berkan Judd award by the Memorial Hospital of New York. Professor Haddow!

PROF. HADDOW: As you mentioned, my own field is that of cancer research. Therefore one's had every chance of seeing at close quarters the potential benefits

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of nuclear energy, first of all in the treatment of cancer, and secondly in the basic investigation of the disease, through the use of many radio isotopes in study with cells of the body, both the normal cells and the cancer cells into which they can be changed. Now here are two examples of the application of nuclear science for human benefit. As a biologist, one has also been greatly concerned by the possible damaging effects of the same nuclear science in its application to warfare. In general, these are well known from Hiroshima and Nagasaki, but much is still to be learned about the possible risks arising from the continued tests of nuclear weapons. In Great Britain the government has requested the Medical Research Council to carry out a survey of all available information upon the medical and biological effects of nuclear radiations. This will later be presented to Parliament. In the United States a similar study is to be carried out by the National Research Council in Washington; and I am very glad to say there is every chance of effective cooperation between these two scientific bodies. The result will certainly be the most informed and considered appraisal available at this time. Without question it should be the greatest value to the British and other governments in guiding their policies in this field. Not only in relation to nuclear weapons, but also in relation to the growing applications of nuclear science in peace. The effects of the massive use of atomic weapons in war would almost certainly be quite disastrous, not only through direct destruction, but also from the immediate and remote effects of radioactivity.

All these matters raise wide questions of the social responsibility of the scientist, and no doubt we'll be discussing these later.

MR. NEWMAN: Thank you Professor Haddow. Our third speaker is another distinguished Briton, Professor Alfred Jules Ayer, Professor of Philosophy at the University of London, a fellow of the British Academy, and a former visiting professor at the University of New York. Professor Ayer!

PROFESSOR AYER: As a philosopher, I shall speak more generally. In the long run, provided that what has come to be known as an atomic war is avoided, the benefits resulting from our ability to harness nuclear energy carry far, grave hazards. What is important is the proviso the peaceful use of atomic energy lies mainly in the future. Atomic bombs exist; and because they exist, I think man's whole attitude toward war and indeed the politics in which war is an instrument must be changed. Up to now it could be argued in certain circumstances war was justifiable. I still think, for example, we were right in 1939 to resist Hitler by force of arms. But war is justifiable only so long as the probable consequences of fighting and winning it are better than the consequences of giving way. The discovery of atomic weapons has changed the situation. It now seems likely the consequences of waging war for both sides, and this is the important point, for both sides, both victor and vanquished, will be worse than any peaceful alternative. Once this fact is realized, it must, if human beings have any sense of self-preservation, and surely they at least have that, revolutionize all their political thinking. One of the benefits of atomic physics may be, and I wish I could say more than may be, that it forces us -- all of us -- in sheer self-interest, to think internationally, for a better form of political organization in which the rule of law extends beyond nations -- covers nations. Clearly this won't come about easily. The habits of purely national thinking are too deeply ingrained. But I believe it to be an essential condition for our realizing -- mankind's realizing -- the better world which scientific knowledge has now put in our reach.

MR. NEWMAN: Thank you Professor Ayer. Our fourth speaker tonight is an American bio-physicist, Professor Eugene Rabinowitch, a professor of biology at the University of Illinois and editor of the "Bulletin of the Atomic Scientists of America," published by Chicago University. Professor Rabinowitch!



PROFESSOR RABINOWITCH: Atomic energy was introduced to the world by the explosions of Hiroshima and Nagasaki. The atomic bomb has since developed into the greatest fact to the survival of nations and perhaps even of the human race, as we will have occasion to discuss more later on this problem. On the other hand, Elliott has emphatically stated the benefits of atomic power and the necessity for its utilization in full scale for nations such as England, which are facing a shortage of other sources of power. The problem for mankind is therefore to separate the good of atomic energy from the evil, and that is a difficult problem because the same material can be used as fuel for industry and as explosives for bombs, and the recent discovery of the H-bomb has increased the destructive capacity of each pound of the explosive by a factor of the thousand. Since 1945 scientists, governments, and the United Nations have wrestled with the problem of how to control the atom and separate its evils from its benefits. A monopoly of the United Nations of all atomic activity has been suggested by the West; an international inspection of national development by the Soviet Union. This disagreement that led to a deadlock. But the problem remains with us. The accumulation of stockpiles of these nuclear explosives, the discovery of the H-bomb, and the start of large-scale development of atomic power only made it more difficult to solve. But solved it must be if mankind is to live in security. And it seems that no solution short of complete and ultimate abolition of war as a means of settling differences between nations will suffice. And this in turn requires a complete change in the political philosophy and political institutions of which they exist and which sovereign nations have been based in the past and are still based now, despite the United Nations. The present relaxation of international tensions can be considered only as a prelude for this change in the political set-up of mankind which is needed to adjust us to the atomic age.

MR. NEWMAN: Thank you Professor Rabinowitch. It is our practice on this program to have our guests comment on one another's statement. Mr. Elliott, are you in agreement with all the comments of your colleagues on this panel?

MR. ELLIOTT: Well, of course, Haddow's point is on cancer and the medical uses of atomic developments, matters in which I'd be wholly in agreement with him. In fact I don't think there would be any disagreement on this table. When it comes to Professor Ayer and Rabinowitch, I may be in a certain amount of disagreement with them. Ayer said it is a problem which we can only hope for a solution by virtue of the instinct of self-preservation of mankind. Oh, that's a pretty good insurance. After all, it is what has preserved us from the use of the atom bomb up to now, and in fact, I am a great believer in the instinct of self-preservation of mankind. It has brought us through ten years of the atom bomb, and I think it will bring us through the next ten years of the atom bomb. So I don't see as much danger as Ayer sees in it. As for Rabinowitch, I think he perhaps overstresses the necessity to find a solution. Why do we need to find a solution. Aren't we better with a deadlock than with a solution. It seems to me that the fact that we both have the atom bomb and that we both realize, and increasingly realize, that we'll be ruined if we use it means that neither of us are going to use it.

MR. NEWMAN: I think Mr. Elliott has brought up some challenging comments. Professor Ayer, do you want to reply?

PROFESSOR AYER: Yes, I think Mr. Elliott's optimism is perhaps a little facile. I can emotionally share it; intellectually I'm a little more doubtful. I agree man has a very strong instinct of self-preservation, but instinct, in spite of what Bergson believed, isn't much use unless backed by intelligence. It seems to me we are playing now with such very dangerous materials that -- particularly politicians, I hate to say this in front of Elliott -- may with the very best in-



tentions in the world, seeking do the best for their own people, their immediate responsibility, and perhaps even ultimately for people at large, land us in disaster. I don't think it's enough to say man won't destroy himself. I think man has got to think and think very hard how to avoid destroying himself. I think it would be very bad if we promulgated the view that it is perfectly all right, that these weapons are too dangerous to even bother. I think they are very, very, very dangerous, and need to be very carefully handled, and what is wanted is very, very hard thinking.

MR. NEWMAN: Professor Rabinowitch, you've been taken to task by Mr. Elliott. What are your comments?

PROFESSOR RABINOWITCH: I think that Elliott is right in saying that the deadlock, the mutual fear of the atomic weapons, has preserved us from a new war for ten years and might preserve us for another ten years. I don't believe, however, that a deadlock can be a permanent solution for a problem which mankind is going to face, not just for the next ten years, twenty years, fifty years, but for the rest of his existence on this earth. I think it has been a challenge that has been placed before the present generation to start thinking about a permanent solution. It doesn't mean that I think that a permanent solution can be found overnight, nor perhaps even in our lifetime. But I think that we cannot really rely on indefinite continuation of the deadlock, and that we have to start exploring and thinking about a final solution.

MR. NEWMAN: We have yet to hear from Professor Haddow. What are your views, Professor?

PROFESSOR HADDOW: I agree with Elliott that no great improvements can be hoped for in a short time. On the other hand, we have not limitless time at our disposal. I therefore agree with Ayer and with Rabinowitch that we must endeavor to secure something better than what is merely based on fear. If mankind were to abolish war through fear alone, that certainly would be an advance. But it escapes the main issue, and we must abolish war by constructing a peace which is based on a greater degree of mutual trust.

MR. NEWMAN: Well, it seems that the panel seems to agree that today with the world split between East and West we cannot overrule the danger of a nuclear war. I'm wondering therefore if you gentlemen could sum up for us exactly what is the position today in regard to the destructive potential of nuclear weapons in modern warfare, both from the immediate and longterm view. Professor Haddow.

PROFESSOR HADDOW: This is not my field. I'm no expert on the destructive effects of these weapons, but as a scientist deeply interested and as a citizen, I think there is no question that used on a certain scale, in effect as we've already said, could be quite disastrous. The effects are not only larger in scope than anything we've experienced before, but they are also different in kind. Through their release of radio-activity can produce widespread effects which are not only immediate, but may be long-contingent and remote, even from one generation to another.

PROFESSOR RABINOWITCH: It is a matter of general knowledge that the original atomic bomb was sufficient to destroy a city of the size of, let's say, 100,000 inhabitants. It is also known and has been confirmed from the most authoritative source -- the President of the United States, the head of the U. S. Atomic Energy Commission -- that one of the new thermo-nuclear bombs, H-bomb, is sufficient to destroy a city of the size of New York or London. In addition, it has been disclosed recently that one of these new bombs, in addition to creating complete destruction, fire, and havoc, over an area of perhaps 100 square miles might also produce a radio-active fallout, a radio-active dust settling on an area of the order of several thousand square miles, which



would create immediate danger for the people who live there, and if they succeeded in escaping from this danger, would make this area uninhabitable for quite a while. These are sufficient to realize what a full-scale atomic war would mean.

PROFESSOR AYER: I have nothing at all to add on the technical side. Professor Rabinowitch has stated the dangers very well, so far as we know them. I should like perhaps to revert to an earlier point. I think there is a contrary danger to one emphasized before, namely, that we depict the horrors of atomic warfare in such lurid colors that people come to think, oh well, disaster hangs over, nothing we can do about it. And here I'd like, for once, to join forces with Mr. Elliott. It seems to me that his approach is the right one, namely, that we must approach the whole problem with the view what can we do now, not, what may happen so many years hence, or what terrible disasters may await us, but what here and now can we bring about, how can we lessen this tension, by what sort of actions? At the moment, you see, all the great powers are like children, each holding on to a tie, and saying, I won't let go until you do, and very much governed by fear in this way, fear and distrust. If we can not so much write horror comics about the atomic bomb, but see it for what it is, realize the implications and the dangers and start thinking, well, what concessions can be made, what agreements can be reached. Then we can get somewhere.

PROFESSOR ELLIOTT: Rabinowitch was saying a little earlier that, after all, the destructive effects are so very much greater than those of the Hiroshima bomb -- the new H-bomb -- in fact, I think they are even greater than he made out because I think the new element is that of a radioactive cloud, which with the big new bombs might -- like a storm in the dust bowl, with a dust cloud blowing for hundreds, if not indeed for thousands of miles and polluting everything in its path, not merely killing people, but killing live-stock, and indeed vegetation, which would mean that even if people took shelter, they'd emerge to a desolated world. Now that, paradoxically enough, seems to me to be the safety of the thing. As Churchill, that great master of epigram and of war, has said, "Now continents are as vulnerable as islands." That's a very new factor, and therefore I agree with Ayer when he said this overhanging doom is simply one of the things we'll have to get accustomed to living with, and therefore let us go ahead and assume that the cloud is not going to break, and that we are going to deal with it as men grappling with emergencies as we grappled with a lot of emergencies before. And after all, I don't see any reason why the very size of this menace shouldn't provide its own remedy.

PROFESSOR RABINOWITCH: I would like to have the last word on the question of immediate decisions on current problems and emergencies versus a final solution. I think that even if in the present we cannot do much more than to take appropriate decisions to avoid current emergencies, it is still important to establish a kind of a final aim, it is important that a final aim, a beacon be established towards which we are aiming and that the current decisions are taken in the light of this philosophy, of this final aim of national policies of enlightened nations.

PROFESSOR HADDOW: I agree with Rabinowitch that everything else seems to be important and immediate, but we must have a final objective towards which to work.

MR. NEWMAN: Setting aside the possibility of nuclear warfare for the moment, what are the hazards involved in the peaceful employment of nuclear energy? First, from the physical aspect -- such things as waste material, accidental breakdown of equipment, and accumulation of radiation. Professor Ayer.

PROFESSOR AYER: It's no good at all asking me on the technical point. I'm not at all equipped to answer it. I shouldn't have thought -- here I speak subject to correction by Professors Rabinowitch and Haddow -- that they were so very great. Obviously



there are certain risks run in conducting atomic tests, and I should very much like to hear their expert opinion on this, and I think I would like to reserve my further remarks until I have heard it.

PROFESSOR HADDOW: Again, I am by no means an expert, but I gather in the industrial handling of these agents, that although the potential risks are very great, they can be controlled with a remarkable degree of efficacy, so I understand. So far as peacetime tests go, one has been very much concerned by the possible effects -- immediate and more remote.

PROFESSOR AYER: Don't mean to interrupt, but how serious would genetic effects of such tests . . .

PROFESSOR HADDOW: That is one matter which the Medical Research Council investigation will do its best to clarify. Personally I feel rather less concerned at the moment by these long-term genetic effects than I was some months ago. I think recent evidence tends to show we may have overestimated or exaggerated them; and if so, that is all to the good and we're glad to know it.

MR. NEWMAN: Professor Haddow, do you have any example of our overestimation of our previous statements on the effects of radiation on the human cell.

PROFESSOR HADDOW: No precise example, but we had thought of a permanent damage to the germ plasm of mankind, so to speak. It is now quite clear that damage from tests to date must be of a very low order genetically in relation to natural mutation and other causes.

MR. ELLIOTT: You would even say in relation to the normal risks of everyday life -- I've seen it stated and I think it's true that we run more risks through wearing a wrist-watch than through any dose of radiation which we are likely to get, and most of us go about carrying a wrist-watch which is being activated by some traces of radioactive substance, and as far as I know, none of us has been seriously damaged, and it looks as if the world hadn't been seriously damaged either. I think that there is a danger that we may have by-passed, the danger to the world is from an atomic war, and not from tests, and I do not believe that from the use of atomic energy also. I would like to go into that later.

MR. NEWMAN: Professor Rabinowitch, you as a bio-chemist, do you agree with some of these statements?

PROFESSOR RABINOWITCH: Yes, I completely agree with what Elliott has said. I think that the general alarm which has been created in the world over some consequences of the Pacific tests has been a good thing and that it has alerted mankind in general to the dangers of atomic, and particular, the hydrogen bomb; but in itself the damage created by these explosions seems to be not different and even smaller than from some dangers which are run even in ordinary maneuvers, of military maneuvers, not to speak of the highway traffic.

PROFESSOR HADDOW: What about x-ray photographs of ourselves, which we are always having taken.

PROFESSOR RABINOWITCH: The only real danger of which people have seriously thought is the danger of exposure of whole nations, if not of the whole mankind, to radioactivity which doesn't create any immediate effect, but in the long run, may affect the hereditary properties of humanity, and it seems from the best information which is available at present, as Haddow has mentioned, that this danger at present is of relatively low level. We are exposed continuously to radiation coming from space. This radiation accounts



for a sizable proportion of natural mutations in human heredity, and the addition to this that has been created by tests seems to be of rather small importance. And I think it is indeed very important that the alarm over these tests and the kind of let-down in this alarm should not be taken at all as signifying that the dangers of the full-scale use in war has been exaggerated.

MR. ELLIOTT: I'm sure about that, but as for the peacetime use -- well, anyone who has a fractured arm or leg and who isn't x-rayed by his doctor immediately complains of malpractice. Anybody who goes to a dentist nowadays gets his teeth x-rayed. Now, after all, we get a bigger dose of radiation in that than we are likely to get by being exposed to all the tests which have ever been held and for the next twenty years.

PROFESSOR RABINOWITCH: I think one of the good things of the present alarm is that it has made doctors, suppose, more aware of the fact of the x-ray exposure should not be given without real need. For example, such questions as the mass test of whole populations for cancer by twice a year x-ray investigation of everybody is now considered in a different light perhaps from what it used to be in the past.

PROFESSOR AYER: I think we are taking this a little bit too narrowly. It seems to me that if atomic energy is harnessed, it's going to transform the whole of our lives -- the people who do harness it are going to face a very different kind of world, a world with its advantages and its dangers. Now, I will say I think -- perhaps others will disagree with me -- that the advantages very greatly outweigh the dangers. I know there are people who look with suspicion upon such development. They say, oh well, things will be made too easy for people, life is becoming altogether too soft a business, what about the challenges, what will people do when they don't have to work. I think all this is rubbish and mischievous rubbish. I think this exultation of the state of nature is a fraud put upon by people themselves who never had to work or to endure poverty or suffer very much. I agree with Hobbes, and I hope you agree with Hobbes and me, that life instead of nature was solitary, nasty, brutish, and short. I think that the more that scientific machines can do our work for us, the better. I don't think so meanly about our fellow creatures as to suppose they can't use their leisure very profitably and very well.

MR. NEWMAN: I noticed you had your hand up before. Are you in agreement with some of the statements here and in disagreement with others, Professor Haddow?

PROFESSOR HADDOW: Yes I think I'm in agreement with some and in disagreement with others. There is a point also raised by Rabinowitch a little earlier, namely, the effect of exposure to radiation of very large populations. As I said before, I personally am less concerned now by the genetical hazards of test explosions than I was some months ago -- very much less concerned. At the same time, I think there's a great deal to learn, and we still await a great deal of information on the effects of long-term exposure of enormous populations.

MR. ELLIOTT: Yes, I'm sure that that will perhaps interest us first in Britain and indeed in England, where we are now, as I say, launched on this course of an enormous use of atomic energy for our daily bread. I agree with Ayer that we've got to use it; it's not a case of life being made too soft. We'll have to run pretty hard to keep in the same place. If we get the same supply of energy in the next hundred years as we've had in the last hundred years, we'll be doing pretty well, for up to now we've been exhausting the capitalized reserves of over 300 million years, and now we're going to draw on our current income -- a very different matter.

MR. NEWMAN: Mr. Elliott, I think Professor Ayer is in disagreement with you on one point, anyway.

PROFESSOR AYER: Not disagreement -- I wanted to put only a question to your superior knowledge, namely, you seem to think, from what you said, that in fact use of atomic energy won't make life easier -- at its very best it will be a substitute for



coal in the 19th century, but won't in the foreseeable future achieve more for us than that. Could you give reasons to back this?

MR. ELLIOTT: Well, the first reason is of course that the present cost of atomic energy, electricity from atomic energy, is as high as the cost from coal and oil fire stations. Of course, you may say this is only the beginning, and we shall learn to use it very much more cheaply and more effectively in the near future. That may be, but on the other hand, it will take a lot to compete with the unlimited reserves, for the moment power, that were made available to us when for the first time we broke into the coal seams and looted the coal of the Carboniferous era. It's going to take an awful lot to make up for that. I think that uranium mining is going to be just as hard and difficult as coal mining, and it will take just as long to get energy by that means as it has taken to get energy out of the coal mines.

PROFESSOR RABINOWITCH: Mr. Elliott, don't you think that for some nations the possibilities of atomic energy are even more spectacular than for Britain, which has to replace an ample supply of coal which it has used in the past, while there are other nations in the world which never had and don't have any such abundant supply of coal and for whom the use of atomic energy may be the first opportunity they have for real industrialization.

MR. ELLIOTT: Well that may be. On the other hand, as these nations explore the subsoil, they are generally finding supplies of fuel under it. The extreme example, of course, is the Middle East, which is now wallowing in enormous supplies of fuel for practically nothing, in the tapping of the great oil wells in Saudi Arabia and elsewhere. I think that it may be that it will offer opportunities to the nations which have not yet got much supply of fuel. But even so, I think that they will find that the fuel that they will buy by the use of uranium, or uranium derivatives, will be as expensive as the fuel they might have bought through coal, and much more expensive than the fuel they might have bought through tanker oil.

MR. NEWMAN: Well, if I can interject here for a moment, from the point of view of the layman anyhow, each age thinks that its latest discoveries are almost the final word, and I'm wondering whether or not -- again from the point of view of the layman -- whether or not atomic energy will have a substitute in the days ahead? Professor Rabinowitch.

PROFESSOR RABINOWITCH: There are two possibilities. One which has been mentioned by Professor Haddow is the possibility of thermonuclear energy one day also is going to be harnessed for peaceful uses, which at the present is an entirely open question. It is not a secret that many people are thinking about it, and many laboratories are perhaps even working on the subject, but it is by no means certain that this will prove to be possible. It depends on certain values of natural constants which may or may not be favorable. Or course, the other possibility, in which I personally am somewhat concerned, is the possibility of using direct solar energy, instead of using stored solar energy in the form of coal and oil -- we might use directly the practically unlimited supply of energy which reaches us from the sun. The difficulty there is exactly the opposite of that of nuclear energy, where the nuclear energy is terribly concentrated and therefore suitable for explosions, and the solar energy is so diffused that you have to devise methods to somehow use economically energy which reaches us in a constant flux, but this flux is so thin.

MR. ELLIOTT: Well, yes, but remember that we already use solar energy; up to the discovery of coal the whole world was run on solar energy. It was collected by the plants and from them by the animals, and let's face it, they both liked doing it. They did it for fun. Grass like growing and cows like eating grass. It's going to be very difficult if we've got to do this by necessity. I rather doubt whether we shall find any more efficient way of collecting solar energy than the old-fashioned way that has gone on since vegetation began on the surface of this planet. But I think we should be wrong if we neglected the possibility not of thermonuclear energy, which is after



all also nuclear energy, but of the more direct use of the breakdown of the atom and the derivation of electricity direct from that, instead as we do now -- burning down the house to cook the pig, we destroy the atom in order to boil water with it. Well, after all, then we send the boiling water into a boiler and drive a dynamo to make electricity. But the atom is made of electricity; you could get at that direct, then certainly we could release energy on an altogether different scale from the energy we get by, as I say, destroying the atom and using it to boil our kettles with.

MR. NEWMAN: Gentlemen, if I may now turn to another side of this subject, and that's the individual and collective responsibility of scientists in this field. Is the responsibility of the scientist, with his special knowledge of the probable hazards, to be greater than that of the ordinary citizen? Professor Ayer.

PROFESSOR AYER: It seems to me that the primary responsibility of the scientist is still, in spite of everything that has happened, is to knowledge; the primary responsibility of the scientist is to follow the argument wherever it leads, to pursue his line of research without worrying about the consequences, and to make it known to others. Well now, this in the modern world has become somewhat -- certainly not in all fields, but in many fields -- somewhat impinged upon. As we all know, certain businesses are not allowed by governments to pursue knowledge in the way they want, or if they are, they aren't allowed to publish it. But I think the scientist has acquired recently a new responsibility, namely, a responsibility for the use to which this information is put, and I think this presents him with a very, very serious problem. I should like to ask the two scientists present what they think about it -- through pursuing their lines of research, they may produce information which can be put to bad uses and which they can't at present control.

PROFESSOR HADDOW: Well, I think it's a central problem, and I don't think we can give any definitive answers; it's a matter which must be studied all the time in the hope we may get the situation cleared. In this country certainly the bulk of people and scientists believe that the scientist has no responsibility in deciding whether his work is to be applied for good or ill. But others, a minority, take another view that we have a special responsibility, and of course this is the problem -- how to define it. There is also the point that must be brought in mind that in addition to being a scientist, a scientist is also a man and a citizen. These two have to be brought together. Lord Russell said something recently rather interesting that the old rule that I just mentioned which was generally accepted is not now false, but is out-of-date. In other words, I think it has to be readapted to modern problems.

PROFESSOR RABINOWITCH: I think that the scientists do have a new responsibility which they didn't have before these obvious consequences of their research for good and evil became so obvious. Some scientists and many people in the general public think that the scientist has an individual responsibility for doing research only of things which are for good and avoiding doing research on things which are bad; and scientists that do so are something like conscientious objectors in the general public. I think, however, that it is even more futile for scientists to try to adopt this position than it is now for a man to avoid making military service in a time when in a war nearly everybody becomes a part of the military effort, whether he is in uniform or not. Even more so a scientist cannot really predict which work is going to be put to beneficial use and actually the same work can be put to destructive or beneficial use. Therefore I think if the scientists have a special obligation at the present time, this obligation lies not in deciding what he should do research on and how his research is going to be used, but in taking active part in public life, trying for information based on special knowledge, not only special knowledge, but special emphasis and realization of the importance of this knowledge, which other people do not share, trying to take part in public life in the direction which would help assure that no advance of science is going to be used for evil purposes, for destructive purposes. I think the scientist do have this responsibility and I also think this is the only responsibility towards society that we have.



MR. NEWMAN: Well, I'd like to hear now from a man who has had responsibility of government, Mr. Elliott.

MR. ELLIOTT: Well, I agree that the thing falls back on the political chiefs, for two reasons. First of all, as Rabinowitch has truly said, you don't know what discovery is going to be good and what discovery is going to be bad. The whole of this arose, not from Einstein's calculations, but from Becquerel's observations of the uranium rays and from Madame Curie's discovery of radium. These were empirical observations, and none of them foresaw anything like this when they started on it; but yet these things were there to be discovered; if they hadn't discovered them someone else would. The political chiefs, on the other hand, have the final responsibility of the use of these things. It is a problem of the will of man; it is not a problem of the invention of man. How are they to be employed? And on that I think that the -- to use a modern term of abuse -- the politicians will have to shoulder the final responsibility, and the scientists are the servants of the politician. I am their master; I have that terrible responsibility.

PROFESSOR HADDOW: The master must know the facts, and there is a very interesting point that Curie himself in his Nobel oration in 1903 expressed some fear as to what might happen if this property of radioactivity were ever employed by criminals among nations.

MR. ELLIOTT: Yes, after he had discovered it though. He discovered it first and then he said to the criminals, this may be very useful to you.

PROFESSOR RABINOWITCH: Well, I think if we would have more politicians like the one we have among us today, who has an understanding, who has only to be given the facts and has enough judgment, enough experience, and scientific background to judge their importance, then perhaps the function of scientists would consist really only in making their findings public and explaining them so that the people can understand them. The fact, however, is that the majority of the public and the vast majority of politicians do not have this capacity for easily and fully understanding the scientific facts, at least not until scientists make a much bigger effort than they did in the past to communicate this understanding.

PROFESSOR HADDOW: My theory is another aspect. I think we were talking of scientists as individuals. There's also the question of the responsibility of science as a whole. I think there is something there -- there is the lesson by example. What we need at the moment in the world is greater trust between the nations. Here is an example of something, namely, science, which has never respected any boundaries and has always contained almost universal trust.

MR. ELLIOTT: Aren't you speaking rather of medical science, Haddow. I mean you and I are doctors. We know the enormous responsibilities which fall on the medical man. But would you say that the ordinary scientist had ever accepted these responsibilities?

PROFESSOR HADDOW: I agree that it applies specially in the case of medicine, but I think one or two generations ago it was fairly complete internationally, less now.

PROFESSOR AYER: What I have against all of you is that you really aren't getting down to cases. There aren't many politicians who know much about science, and indeed, they really wouldn't have got where they were if they did; they wouldn't have had the time; they wouldn't have developed the art that may have put them in a position of political power. And equally I think I go along with Rabinowitch. He said, well the scientist can exercise his responsibility by engaging in public life, and so on. After all, science is a full-time job. To be a good scientist you've got to devote yourself altogether. It's no good saying on the side I'm going to engage in politics and change the course of the world. You might do both badly.

MR. ELLIOTT: Well, wait a minute; wouldn't you take the great Greek civilization where all men were assumed to be politicians by nature and continuously, and nobody has ever been greater scientists than the great Greek thinkers.

PROFESSOR AYER: Oh, wait. First of all, the Greek states were city-states, very small states where all populace, except the slaves, the enfranchised populace, could meet



and discuss. Secondly, of course, the Greeks weren't scientists; they were mathematicians but in fact, not good at experimental science, and surely, Mr. Elliott, you indeed must know that since the 19th century science has become exceedingly complex. It's almost impossible now for anyone to cover the range of life; you must be a specialist; it's impossible to hope to embrace all human knowledge in the way that the Greeks could. Their knowledge, great though it was, was greatly limited.

PROFESSOR HADDOW: But surely Spinoza, was it not, who ground spectacle glasses for a living. That was a very specialized activity. Yet, he found it possible to be a great philosopher as well. I don't see any reason why the fact of high specialization should make it impossible for a man to indulge in high thinking as well.

PROFESSOR AYER: If politics isn't more difficult than optics and optics just reduced to grinding lenses, then Professor Rabinowitch can also be a politician. Otherwise I won't let him.

MR. NEWMAN: Well, Professor Haddow seems to be in disagreement with one of these gentlemen, and I'm not quite sure at this point.

PROFESSOR HADDOW: Well, I should rather say in agreement with Elliott in his last remarks. There's another point I'd like to make, as a practical point. Ayer I think wondered if we could raise cases. That is, that scientific responsibility has been increasingly expressed in this country in the last year or two, and I think has been effective up to a point. I think it has produced a certain result.

PROFESSOR RABINOWITCH: I think that the activity in which the so-called atomic scientists in America have engaged since 1945 has been on the whole a useful thing, both for the better understanding of the problems of the atomic bomb by the population and the Parliament and from the point of view of their becoming more fully grown-up citizens of the state. And I think, even if Ayer might be right by devoting some part of their life to public activity they might become a little less good a scientist, I think this is just their duty to give a part of it.

PROFESSOR HADDOW: Wouldn't you say also that the actual emphasis on security, especially in the States, had done a certain amount of damage even to the scientific knowledge which these people are accumulating. After all, unless you're good enough to make a discovery for yourself, you'll scarcely understand what's told you even by the most skillful kind of spy. And is it not a fact that we do tend to exaggerate the amount that can be concealed and to thereby wrap ourselves up in a cellophane lining which makes it awfully difficult to look out through it.

PROFESSOR AYER: Being conciliatory right now, I want to say that I agree to a certain extent with Rabinowitch, but I think public activity should arise out of their work, not be divorced from it. It should be in the direction of seeing that their results are published, resisting suppression of them, warning people of the dangers of the utilization of what they are working at.

MR. ELLIOTT: Yes, both from the scientific and the political aspect, freedom of knowledge is the best policy really. And that's the fundamental thing, we've got to remember. It's the best scientific policy as well as the best political policy.

PROFESSOR HADDOW: There's another point I'd like to make that I think the scientist has a duty, as Rabinowitch has said, for the sake of science. I think the existence of science in the future is dependent upon scientists playing their part in this way.

PROFESSOR RABINOWITCH: I fully agree.

MR. NEWMAN: Well, in about 1 minute and 45 seconds, who would care to sum up our situation -- THE ATOM: ITS BENEFITS AND ITS HAZARDS.

MR. ELLIOTT: Well, if I have to do it in a very short statement, it would be this -- that the unlocking of this new source of energy has been a great risk as well as a great possible advantage. The risk is here and now; the advantage is in the future. But for all that, it was on the whole inevitable that this should be done. You cannot control the mind of man and therefore we got now to learn to control this thing or die. I believe that the increasing sense of responsibility that we all feel means that we will control it.